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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of : **Confirmation No. 6167**  
Takatsugu TAKAMURA et al. : Attorney Docket No. 2003\_1757A  
Serial No. 10/726,652 : Group Art Unit 1711  
Filed December 4, 2003 : Examiner Irina S. Zemel

PRODUCTION METHOD OF BIODEGRADABLE  
PLASTIC AND APPARATUS FOR USE IN  
PRODUCTION THEREOF

**Mail Stop: AF**

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ACCOUNT NO. 23-0975

**PATENT OFFICE FEE TRANSMITTAL FORM**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450  
Sir:

Attached hereto is a check in the amount of **\$760.00** to cover Patent Office fees relating to filing the following attached papers:

**Petition for Extension of Time ..... \$510.00**

**Notice of Appeal ..... \$250.00**

A duplicate copy of this paper is being submitted for use in the Accounting Division, Office of Finance.

*The Commissioner is authorized to charge any deficiency or to credit any overpayment associated with this communication to Deposit Account No. 23-0975, with the EXCEPTION of deficiencies in fees for multiple dependent claims in new applications.*

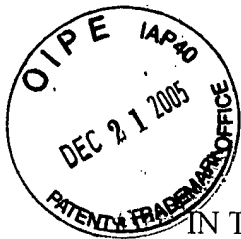
Respectfully submitted,

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December 21, 2005

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2003\_1757A



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PRODUCTION METHOD OF BIODEGRADABLE  
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**RESPONSE UNDER 37. CFR 1.116**  
**EXPEDITED PROCEDURE**  
**EXAMINING GROUP 1711**

**REQUEST FOR RECONSIDERATION**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This is responsive to the Official Action dated June 21, 2005, the time for responding thereto being extended for three months in accordance with a Petition for Extension of Time and a Notice of Appeal submitted concurrently herewith.

Favorable reconsideration is respectfully requested in view of the following remarks.

Claims 1, 2, 4 and 5 are rejected under 35 USC 103 as unpatentable over Ichikawa of record. This ground of rejection is respectfully traversed.

The basis of the rejection is that a mixture of two catalysts would have been obvious with a reasonable expectation of adequate results absent showing of unexpected results that can be clearly attributed to use of a mixed catalyst.

The Applicant has prepared an experimental comparison to demonstrate the unexpected results of the mixed catalyst system of the present invention. The experiments compare the manufacture of polylactic acid from lactic acid monomers by the direct condensation method using the combined catalyst system of this invention with the same catalysts used alone. The

following description summarizes the comparative experiments and experimental results. A formal Rule 132 Declaration will be submitted in due course.

#### Example 1

The catalyst used in this Example was 0.2% of the zinc chloride and 0.5% of the stannous chloride according to the invention.

90% L-lactic-acid monomer (7.5 kg) was supplied to the reaction apparatus shown in Fig. 3 of this application through the inlet 5 of the main body 1a. The monomers were mixed slowly with mixing device 4, while heating at 100 to 150°C by the heating device 3, and dehydrated over about 5 hours under a vacuum using a decompression device 2 which was applied at -0.20 to -0.05 MPa (20 to 5 mmHg). The degree of vacuum became high in the early stage of dehydration, and became low in the second half.

Then, after returning to normal pressure, the catalyst (0.2% of the zinc chloride and 0.5% of the stannous chloride) was added through inlet 5. The direct polycondensation reaction was carried out for 10 hours at a churning speed of 100 rpm, a temperature of 180°C, and a degree of vacuum -0.08 to -0.05 MPa (8 to 1 mm Hg). The degree of vacuum became high in the early stage of the reaction, and became low in the second half. The terminal point of the reaction was determined by the amount of emergence of steam and speed change which were discharged from vent 6, as detected by a sensor for water vapor 13, and caught by a measuring device for water vapor 14, and by pressure reducing unit 2. The amount of emergence of steam and speed change became high in the early stage of the reaction, and became low in the second half.

Next, the screw shaft 9 was pulled up within discharge cylinder 7 to open the product outlet 8 and polylactic acid was taken out from there. The weight average molecular weight of the obtained polylactic acid was 120,000.

#### Example 2

The catalyst used in this Example was 0.1% of the zinc chloride and 0.4% of the stannous chloride according to the invention.

The same reaction was carried out according to Example 1, except that the catalyst used was 0.1% of the zinc chloride and 0.4% of the stannous chloride. The same terminal point of the reaction was achieved after the direct polycondensation reaction was carried out for 12 hours. The amount of average molecular weight of the obtained polylactic acid was 110,000.

### Example 3

The catalyst used in this Example was 0.5% of the stannous chloride alone.

The same reaction was carried out according to Example 1, except that the catalyst used was 0.5% of stannous chloride alone. The same terminal point of the reaction was achieved after the direct polycondensation reaction was carried out for 18 hours. The amount of average molecular weight of the obtained polylactic acid was 100,000.

### Example 4

The catalyst used in this Example was 0.5% of the zinc chloride alone.

The same reaction was carried out according to Example 1, except that the catalyst used was 0.5% of the zinc chloride was used. The same terminal point of the reaction was achieved after the direct polycondensation reaction was carried out for 20 hours. The amount of average molecular weight of the obtained polylactic acid was 80,000.

The following Table summarizes the results of the experiments of Examples 1-4.

Example	Catalyst (weight %)	Weight average molecular weight	Reaction time(h)	Polycondensation temperature(°C)	Degree of vacuum(MPa)
Example 1	Zinc chloride 0.2 Stannous chloride 0.5	120,000	10	180	-0.05 ~-0.08
Example 2	Zinc chloride 0.1 Stannous chloride 0.4	110,000	12	180	-0.05 ~-0.08

Example 3	Stannous chloride 0.5	100,000	18	180	-0.05 ~-0.08
Example 4	Zinc Chloride 0.5	80,000	20	180	-0.05 ~-0.08

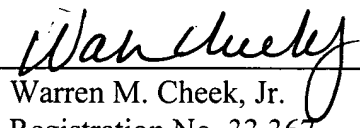
In summary, it is respectfully submitted that the foregoing experiments demonstrate that the unexpectedly superior results of the combined catalyst system of zinc chloride and stannous chloride of this invention. The combined catalyst system of this invention enables the manufacture of polylactic acid having a higher weight average molecular weight in a reduced reaction time in comparison to using the same individual catalysts. Such unexpected results were not obvious from the prior art at the time of this invention.

In view of the foregoing, it is respectfully submitted that the rejection has been overcome by the showing of unexpected results.

Favorable reconsideration and allowance is solicited.

Respectfully submitted,

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